*Technology Opportunity*

Software Tool for Modal Analysis and Control Design

The Eigensystem Realization Algorithm (ERA) is a software tool for calculating modes of vibration from test data. Engineers use modes of vibration to solve practical vibration problems and to design active-vibration-control systems. To date, ERA has been used primarily on spacecraft and aircraft structures; however, it is highly effective for structures of any type.
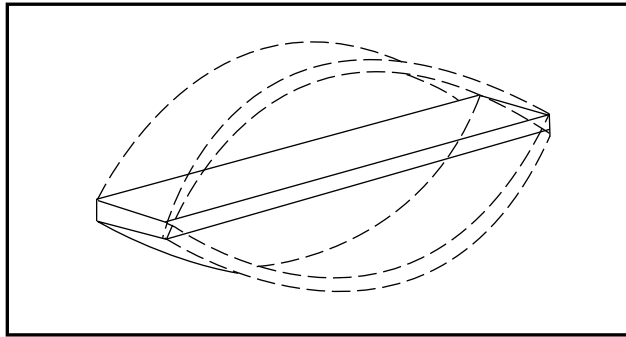
1st Bending Mode
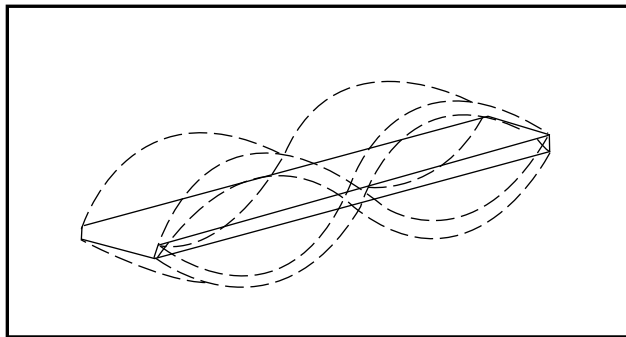
2nd Bending Mode

Potential Commercial Uses
• Automotive and construction vehicles
• Rotating machinery
• Sports equipment (e.g., skis)
• Musical instruments (e.g., violins)
• Active control of building vibration
• Active control of bridge vibration
• Active noise control
• Precision manipulators (robotics)
• Failure detection
• Characterization of electrical circuits

Benefits
• Accuracy: ERA is accepted throughout the aerospace industry based on its proven accuracy with both simple and complex structures. Numerous publications document these tests.
• Features: Technical features of ERA include multiple-input, multiple-output formulation for closely spaced modes and accuracy indicators for result validation.
• Versions: Available in 2 software versions:
    1. VAX VMS FORTRAN (emphasizes structural modal analysis)
    2. MATLAB (emphasizes control design)
• Heritage: NASA engineers have continuously improved this software since 1984.

The Technology
Vibration occurs whenever mechanical systems move. Excessive vibration can cause discomfort or annoyance (including noise), and damage or inefficiencies in the system. Engineers solve vibration problems using "modes of vibration," which are "natural" frequencies of a structure at which large vibration occurs. ERA calculates modes of vibration from test data.

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Engineers at NASA Langley Research Center developed ERA in 1984 as a tool for modal analysis and control design of future large space structures, such as NASA's space station. Since then, it has been used and improved considerably. The VAX VMS FORTRAN version of the software includes a main program and 70 pre- and post-processors. It provides complete modal analysis capabilities. There are no limits on problem size. The MATLAB version of the software is a library of functions for generating state-space models and observer gains. More than 100 requests have been received from other organizations for the ERA software.

Space Application
(Earth observation satellite)
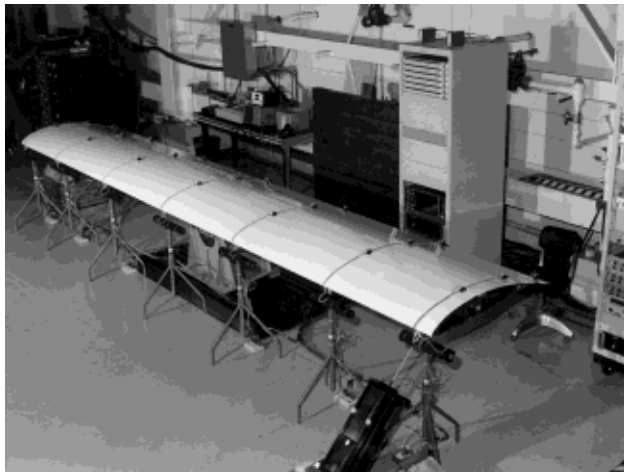
Aeronautics Application
(Perseus aircraft wing)

Options for Commercialization
NASA offers this software to commercial users at a minimal fee. A User's Guide accompanies the software. The developers seek users' comments and experiences, and they are available on a limited basis for consultation. An exclusive license to market the ERA software will NOT be granted at this time because software development continues as an integral part of NASA's internal research program.

Contact

If your company is interested in the ERA technology, or if you desire additional information, please contact:

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Key Words

Modal analysis, control design, Eigensystem Realization Algorithm (ERA), vibration analysis, structural test software

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